

36th Annual Gun & Ammunition Symposium
Add-on Miniature Proximity Fuze
for the
M80 Submunition Grenade



Donald R. Garvick

John P. Martin *

Weapons Department NSWCIHD
Naval Sea Systems Command



OUTLINE



- ◆ **ERGM Weapon System Overview**
- ◆ **M80 Submunition PIP Goals**
- ◆ **Fuzing Approach & Challenges**
- ◆ **Program Status and Achievements**
- ◆ **ERGM/M80 PIP System Integration Plan**



Weapon System Description



MISSION:

Naval Surface Fire Support of Ground Troops



- ◆ **Extended Range Guided Munition (ERGM)**
 - 5" Rocket Assisted EX-171 Mod 0 Projectile
- ◆ **ERGM Warhead - Payload Assembly EX-3**
 - 72 M80 Type Submunitions with M234 SD Fuze
- ◆ **NSFS ERGM M80 PIP**
 - Increase Lethality of M80 Type Submunition

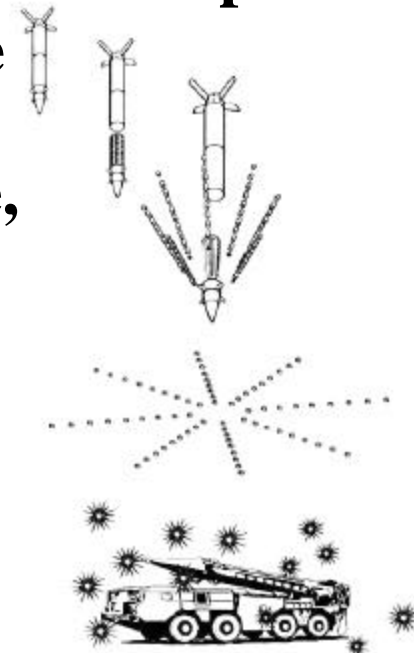


NSFS ERGM M80 Product Improvement Program (PIP)



PROGRAM GOALS:

- ◆ **Develop an Add-on Proximity Fuze System**
 - **Inserted within the M234 SD Fuze Envelope**
 - **Minimal Impact to M234 SD Fuze High Rate Production Equipment**
 - **Meet ERGM Safety, Performance, Environmental, & Life Cycle Requirements**





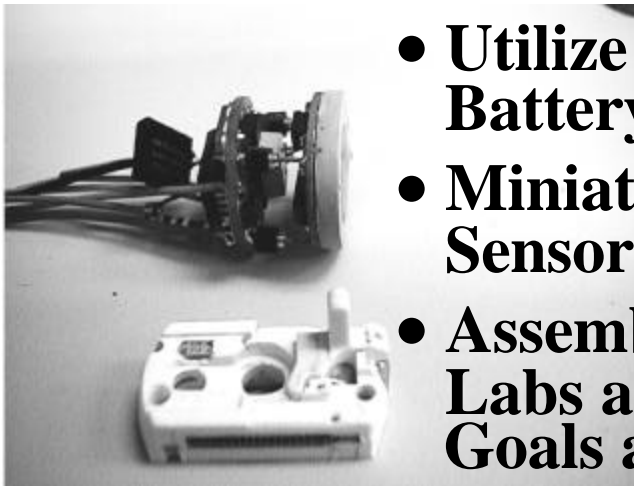
NSFS ERGM M80 PIP

Proximity Fuze System Insertion



TECHNICAL APPROACH:

◆ **One-for-One Replacement of the M234 Self-Destruct (SD) Fuze Slide Assembly**



- **Utilize Gun Launch Environment for Battery Activation**
- **Miniaturize the FM/CW RF Proximity Sensor of the M734A1 Mortar Fuze**
- **Assemble Expertise from Army / Navy Labs and Industry to Achieve Technical Goals and Reduce Critical Risk Areas**





NSFS ERGM M80 PIP

Proximity Fuze System Insertion



MAJOR CHALLENGES IN APPROACH:

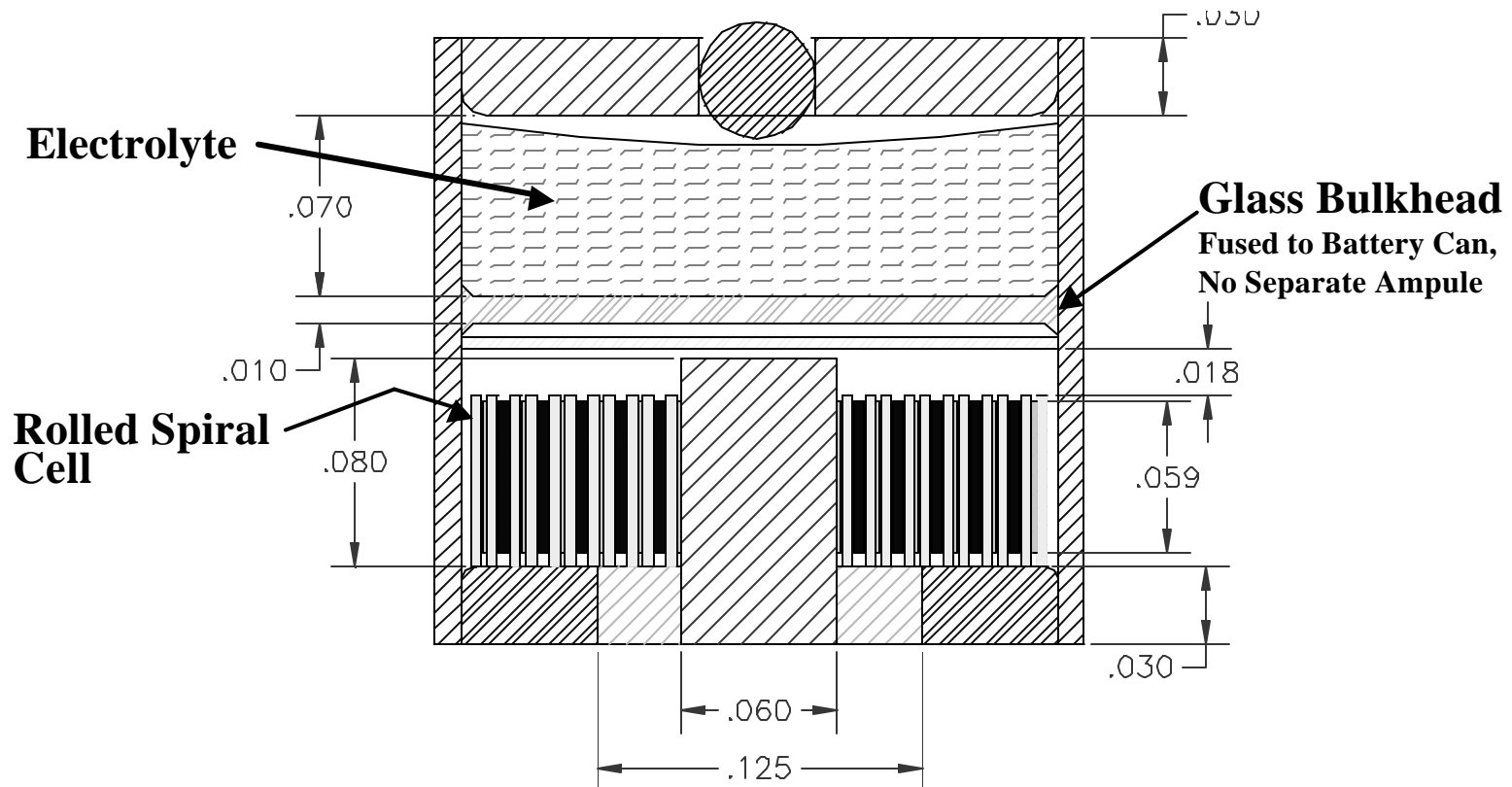
- ◆ **New Reserve Battery Development**
- ◆ **Miniaturized Very Low Power RF Transceiver & Signal Processor Electronics**
- ◆ **Functional Miniaturized Antenna Design**
- ◆ **Slide Assembly Packaging / Producibility**



NSFS ERGM M80 PIP

Basic Battery Design

EAGLE EPICHER
TECHNOLOGIES, LLC



Reserve Cell General Arrangement



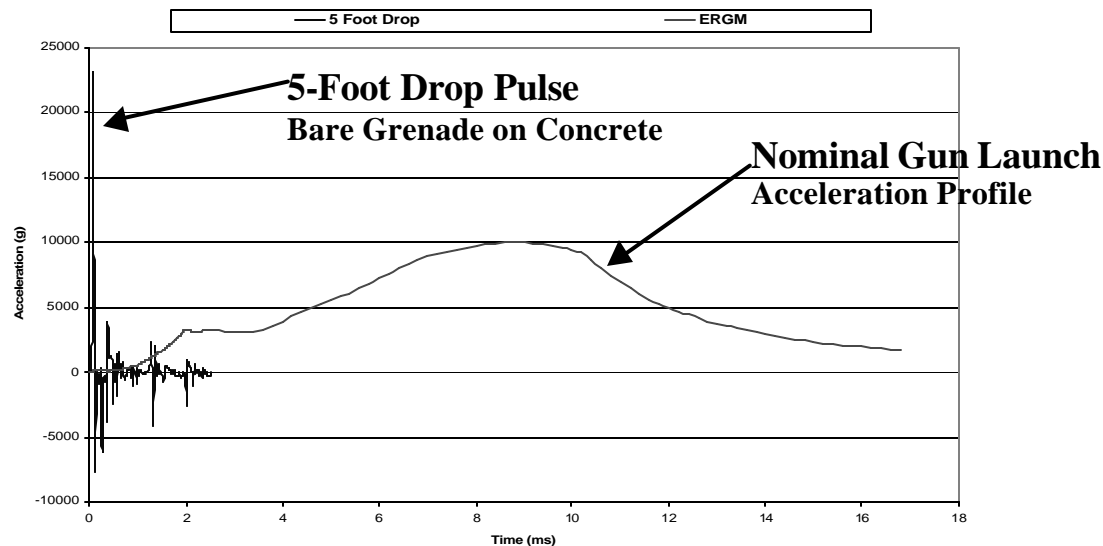
NSFS ERGM M80 PIP

Baseline Battery Design



Demonstrated Performance & Survivability

- ◆ Activation at Min & Nominal Simulated Gun Launch Environment
- ◆ Resists Activation from 5-Foot Drop
- ◆ Activated Batteries Survived/Performed in Simulated Payload Expulsion Shocks



VHG Shock Tester
Simulates Payload Expulsion



NSFS ERGM M80 PIP

Reserve Cell Battery Development



- ◆ **Picatinny 155mm Rail Gun Facility**
 - **Closely Simulates Launch Pulse and Set Forward Deceleration at Barrel Exit**



Picatinny Rail Gun Facility



NSFS ERGM M80 PIP

Proximity Fuze System Insertion



Modified M734A1 Proximity Sensor Architecture

- ◆ MMIC Transceiver & Signal Processor IC Power Reduced to 0.075 Watts vice 0.551 Watts

M734A1
Transceiver



M80 PIP MMIC
Transceiver



NSFS ERGM M80 PIP

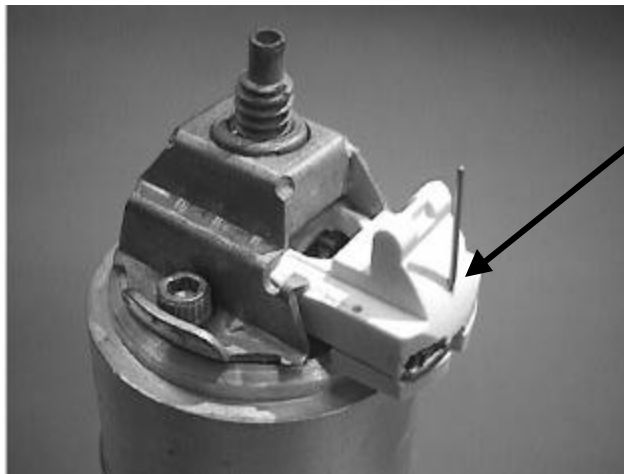
Proximity Fuze System Insertion



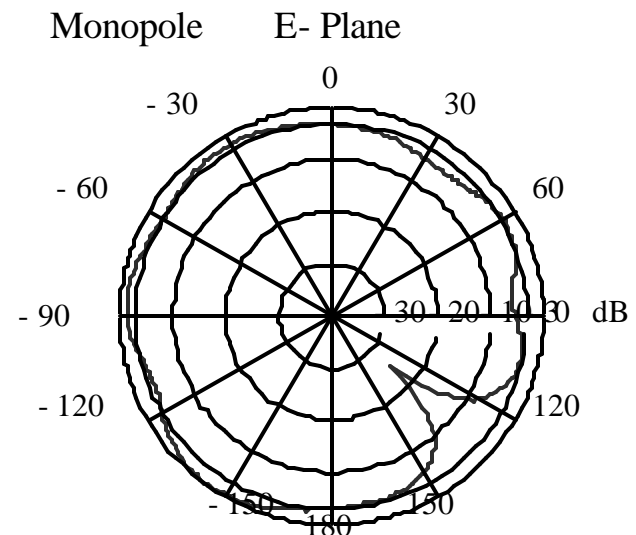
Functional Antenna Designs

◆ Narrow Band Monopole

- Molded within Slide Most Desirable
- Antenna Length / Slide Position Critical
- Acceptable Radiation Pattern



Antenna &
MMIC within
Slide





M80 PIP Proximity Sensor Feasibility Demo Drop Tests





NSFS ERGM M80 PIP

Proximity Fuze System Insertion



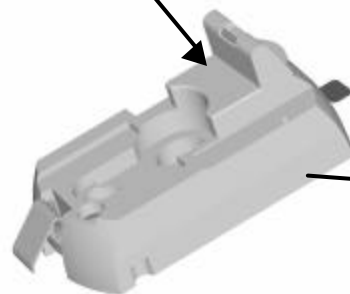
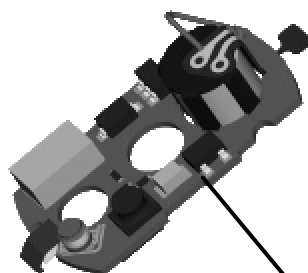
◆ One-for-One Slide Assembly Approach Determined Feasible and Produducible



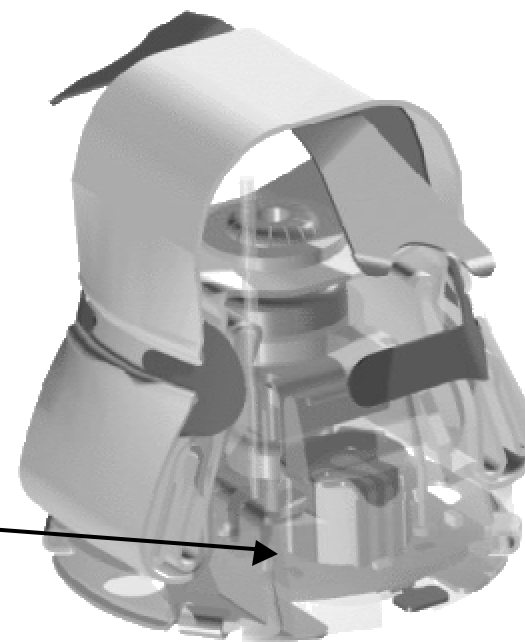
M80 Grenade

**Replaced M234
Slide Assembly**

Proximity Fuze PWB



Molded Slide Ass'y



Proximity Fuze Ass'y

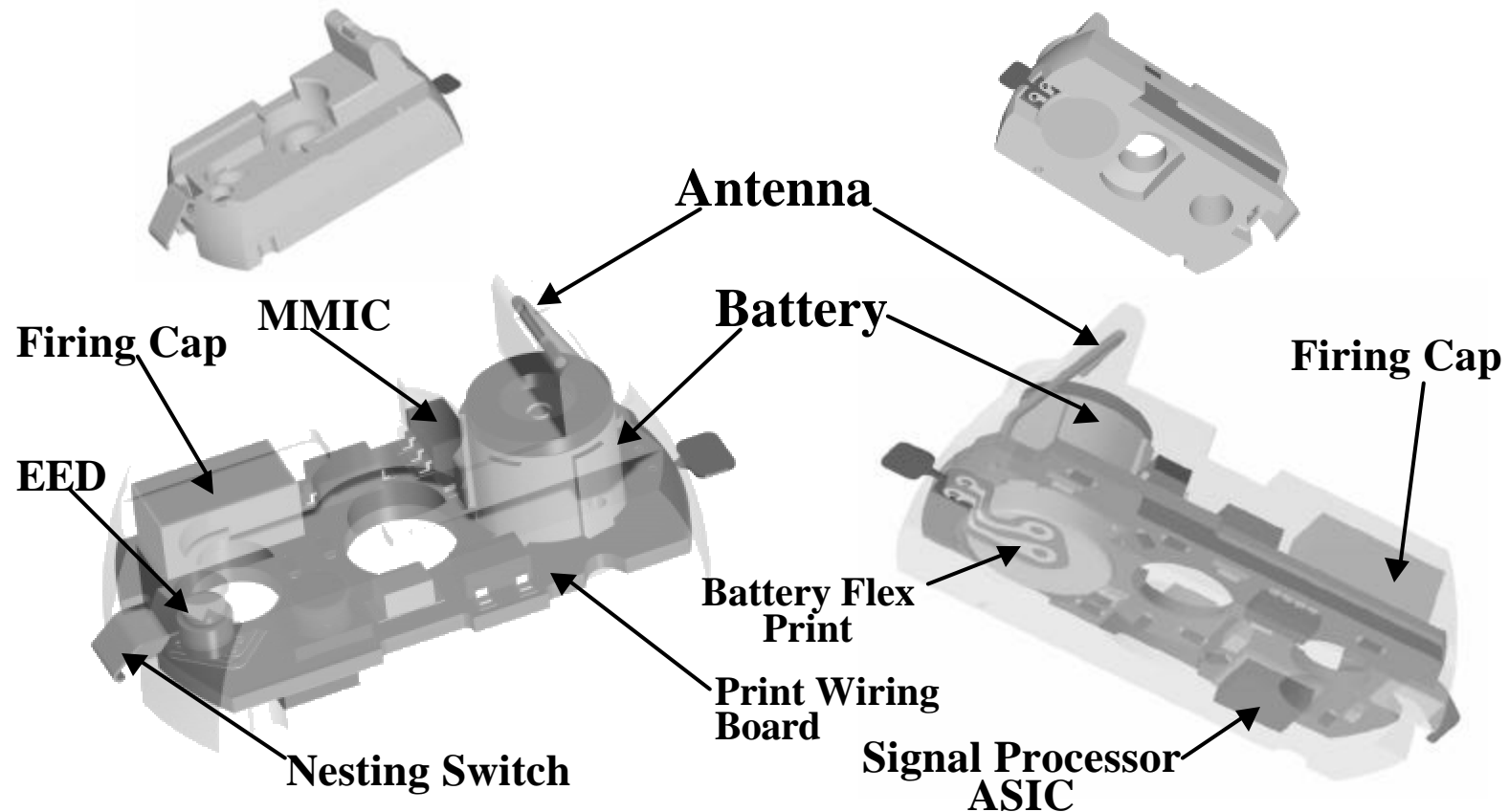


NSFS ERGM M80 PIP

Proximity Fuze System Packaging



◆ Major Components Layout of PWB/Slide Assembly





NSFS ERGM M80 PIP

Proximity Fuze System Insertion



PROGRAM STATUS SUMMARY:

- ◆ **Successful Battery Risk Mitigation Efforts**
- ◆ **One-for-One Slide Assembly Concept Feasible and Producible**
- ◆ **HOB Performance Envelope Demonstrated**
- ◆ **M80 PIP Related System Safety Analyses and Safety Assessment Completed**
- ◆ **Remaining Major Producibility Issue**
 - **Replacement of Current Self-Destruct PWB EED**

M80 PIP ERGM INTEGRATION SCHEDULE

2/26/01
KEN

